

REMARKS

1. In the above-captioned Office Action, the Examiner rejected claim 3 under 35 U.S.C. §112, second paragraph. Claims 1-4, 7, 8, 10, 11, 14, 16, and 18, were rejected under 35 U.S.C. §102(a) in view of Wlodarczyk et al. (U.S. Patent No. 6,622,549). Claims 9, 13, 17, and 20 were rejected under 35 U.S.C. §103(a) in view of Wlodarczyk. Claims 5, 6, and 19 were rejected under 35 U.S.C. §103(a) given Wlodarczyk in view of Bunch et al. (U.S. Patent No. 5,000,043). These rejections are traversed and reconsideration is hereby respectfully requested.

2. Claim 3 was rejected under 35 U.S.C. §112, second paragraph. Applicant calls the Examiner's attention to the following excerpts from the specification that support claim 3.

[0014] FIG. 2 shows an apparatus for testing a fuel injector 201. The apparatus includes a fluid tank 203 that supplies a fuel pump 205. The fuel pump 205 discharges into a fuel rail 207 that is connected to one or more fuel injector inlets 211. **When the apparatus is a test engine, the fuel rail 207 may be connected to more than one fuel injector.** Further, the fuel rail 207 may be connected to a pressure regulation device (not shown) that controls the fluid pressure in the fuel rail 207. An actuator 209 controls the injection of fuel into and through the fuel injector 201, and the fuel injector 201 includes a nozzle 213 through which fuel is discharged.

[0025] As shown in FIG. 4b, the pressure sensor 215 may alternatively be mounted adjacent to an orifice 413 disposed in the needle 403. In this embodiment, the orifice 413 is located adjacent to the fluid cavity 405. The pressure sensor 215 is adjacent to the orifice 413, such that fluid pressure in the fluid cavity 405 is communicated to the pressure sensor 215. **This alternative is applicable for the testing of fuel injectors in diesel engines because the pressure sensor is not mounted in the combustion chamber.** In either embodiment, the pressure sensor 215 is in communication with the fluid cavity 405 through either orifice 411 or 413, and a leak-resistant seal is advantageously formed between the nozzle 213 or the needle 403 and the pressure sensor 215.

[0032] An advantage of the present invention is the measurement of fluid pressure near or within the nozzle 213 of the fuel injector 201. The fluid pressure in the fluid cavity 405 between the nozzle 213 and the needle 403 may be referred to as sac pressure. Both the pressure sensor type and location may affect accurate measurement of sac pressure. Because piezoelectric quartz pressure transducers are a type of pressure sensor that is less susceptible to distortion caused by mechanical stresses induced, for example, in high-pressure

applications, this type of pressure sensor is advantageously utilized to measure high fluid pressures, such as diesel fuel injector sac pressures or pressures changes in fluid cavities generally. **Piezoelectric quartz transducers may advantageously be utilized in a high-pressure test apparatus or in test engines, such as diesel engines.** Piezoelectric quartz transducers may advantageously be used to monitor diesel engine combustion chamber events or to indicate fluid flow from a fuel injector.

Thus, the specification clearly supports both a chamber in an apparatus outside an engine as well as a chamber that is a combustion chamber in an engine. Therefore, claim 3 is shown to be in compliance with 35 U.S.C. §112, second paragraph.

3. Claims 1-4, 7, 8, 10, 11, 14, 16, and 18, were rejected under 35 U.S.C. §102(a) in view of Wlodarczyk. Applicant re-asserts the argument concerning the Wlodarczyk reference, as set forth in the previous response. In summary, Wlodarczyk does not teach an orifice disposed in the nozzle of the fuel injector because the channel 16 of Wlodarczyk is not in the nozzle. It is well known in the art that the nozzle of an injector is at the bottom of the injector.

Examiner states that (A) Applicant has offered no evidence to support his position, and (B) the injector nozzle of Wlodarczyk extends up to and includes the area which houses the orifice 16. In response, Applicant presents the following:

(A) It is well known in the art that an injector has a nozzle at a tip from which fuel is sprayed out of the injector. By definition, nozzles are features used to speed up or direct a flow of fluid. In support of Applicant's argument, Examiner's attention is called to the following references:

i) Stoecklein et al. (U.S. Patent No. 6,814,302). In FIG. 1 Stoecklein clearly shows a *nozzle* (16) at the bottom of an injector assembly (18).

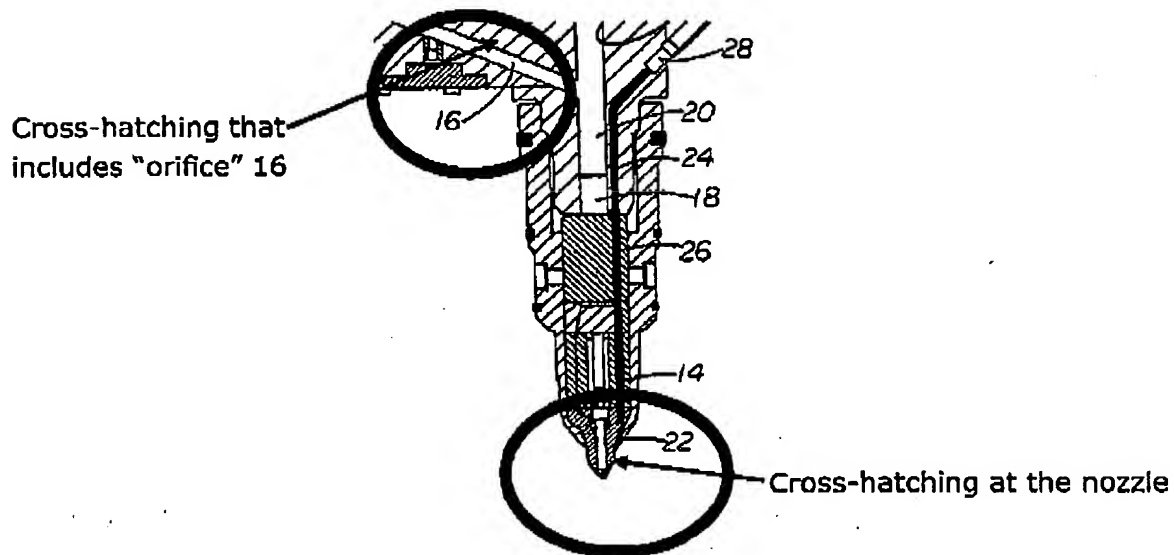
ii) Petrone et al. (U.S. Patent No. 6,814,313). In FIG. 1 Petrone clearly shows a *nozzle* (3) at the bottom of an injector (1).

iii) Okamoto et al. (U.S. Patent No. 6,588,399). In FIG. 3A Okamoto clearly shows a *nozzle* portion (26) at the bottom of a fuel injector (10).

iv) Boecking (U.S. Patent No. 6,557,529). In FIG. 1 Boecking clearly shows an injector *nozzle* (42) at the bottom of an injector (1).

As is evident from the above references, the channel 16 Wlodarczyk shows in his FIG. 1, is *not* formed in the nozzle of the injector.

(B) The injector nozzle of Wlodarczyk does not extend up to and does not include the area which houses the orifice 16. The Examiner's attention is called to FIG. 1 of the Wlodarczyk reference, a pertinent portion of which is included below.



It is clear that the cross-hatching at the nozzle of the injector in FIG. 1 of Wlodarczyk is much more dense and definitely different from the cross-hatching that includes the "orifice" 16.

Thus, the Applicant has shown that it is well known in the art that the nozzle of a fuel injector is at the bottom or tip of a fuel injector. The Examiner has provided no objective evidence that his interpretation that a nozzle for a fuel injector includes portions of the fuel injector other than the bottom or tip of the fuel injector. The Applicant respectfully requests objective evidence of the Examiner's interpretation to support his statements.

Therefore, Wlodarczyk does not teach *an orifice disposed in the nozzle and a pressure sensor adjacent to the orifice*, as stated in independent claim 1; *a fluid cavity disposed in the nozzle and a pressure sensor arranged to measure pressure in the fluid cavity*, as stated in independent claim 10; or *communicating fluid to a pressure sensor through a first orifice disposed in the nozzle*, as stated in independent claim 14. Wlodarczyk clearly shows in his FIG. 1 that the fluid pressure sensor 12 is not in the nozzle of the injector.

Hence, the applicant respectfully submits that independent claims 1, 10, and 14 are shown to be allowable over Wlodarczyk and may be passed to allowance.

Furthermore, claims 2-4, 7, 8, 11, 16, and 18, are dependent upon an independent claim that is shown to be allowable. For all these reasons, the dependent claims are themselves allowable.

4. Claims 9, 13, 17, and 20 were rejected under 35 U.S.C. §103(a) in view of Wlodarczyk. Even if one were to make a substitution of the optical fiber sensors of Wlodarczyk with piezoelectric quartz transducers as stated in claims 9, 13, and 20, or control the chamber operating pressure as stated in claim 17, the resulting combination would fail to yield the invention as claimed because Wlodarczyk does not teach the unique subject matter of independent claims 1, 10, and 14, as shown above.

Moreover, claims 9, 13, and 17, are dependent upon an independent claim that is shown to be allowable. For all these reasons, these dependent claims are themselves allowable.

5. Claims 5, 6, and 19 were rejected under 35 U.S.C. §103(a) given Wlodarczyk in view of Bunch. Even if one were to combine the pressure control valve or the flow metering unit taught by Bunch with the teachings of Wlodarczyk, the resulting combination would fail to yield the invention as claimed because Wlodarczyk does not teach the unique subject matter of independent claims 1, 10, and 14, as shown above.

Moreover, claims 5, 6, and 19, are dependent upon an independent claim that is shown to be allowable. For all these reasons, these dependent claims are themselves allowable.

6. Examiner points out that none of the independent claims 1, 10, or 14, require the pressure sensor, itself, to be disposed within the fuel injector nozzle, and thus, a contradiction exists between the Applicant's invention as claimed and the benefits as argued in the previous response. Applicant's argument of measuring fluid pressure with a sensor disposed in the nozzle of a fuel injector refers to one embodiment of the invention where the pressure sensor is disposed in the needle of

the injector, as stated in claims 12 and 15. Because the needle of the injector is disposed in the nozzle, as stated in claim 10, Applicant's argument is not a contradiction.

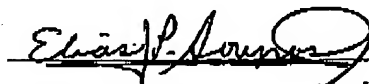
7. The above amendment and response is necessary because it places the application in condition for allowance and was not previously entered because it arises from Examiner's arguments in the Final Office Action.

8. The Examiner is invited to contact the undersigned by telephone or facsimile if the Examiner believes that such a communication may advance the prosecution of the present application. Notice of allowance of claims 1, 2, and 4-20, is hereby respectfully requested.

Respectfully submitted,

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